

From: [Werkema, Dale](#)
To: [Kady, Thomas](#); [Coltrain, Katrina](#)
Cc: Todd.Downham@deq.ok.gov; [Prince, George](#); [Powell, Greg](#)
Subject: RE: Wilcox Call -- Purpose, DQOs, SOW, Schedule
Date: Friday, June 12, 2015 10:26:49 AM

Hi Tom and Katrina,

Understood. Thanks Katrina for the details. I am happy to participate in the call on Wednesday. A few thoughts below.

1. I suggest considering a phased geophysical survey approach, such that the results from initial geophysical surveys are used to constrain the next investigations.
2. If the objective is to find any subsurface remnants of the refinery such as piping, buried tanks, etc. then a magnetic survey may not achieve that objective. Mag surveys will respond only to materials with differing magnetic susceptibility (i.e. ferrous). It seems what is needed is a survey to locate anything metallic (i.e., ferrous and non-ferrous). For this purpose a time domain electromagnetic (TDEM) survey would be best. Specifically, a Geonics EM-61 survey is great for mapping subsurface metallic objects. I have examples of this exact type of survey at a former refinery, if you are interested
3. Based on the results of the EM-61 survey, the locations of resistivity and induced polarization (IP) surveys could be determined and acquired. These methods (acquired essentially simultaneously) will determine the electrical properties distribution within the site, aid in the CSM development (perhaps even depth to bedrock), and have been shown to locate and map contaminant plumes. I have examples of these as well. IP is something that not many environmental geophysical contractors do, but I strongly suggest it is considered. A resistivity survey without IP leaves many questions, while an IP survey interpreted in concert with resistivity yields more information about the electrical properties of the subsurface and can constrain interpretations.
4. I am curious what type of seismic survey is proposed and I assume this is to help determine the depth to bedrock. Is this a refraction or reflection survey, or perhaps MASW?
5. Based on the results of the above investigations, a GPR survey may be warranted to map structure and investigate if such structures are preferential. GPR has been shown to map contaminant plumes, so this might help with the resistivity and IP survey.

Hope this helps. Perhaps the field work is already planned. Either way, I am willing to help as needed. The results from the initial sampling efforts will also help.

Best,

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From: Kady, Thomas
Sent: Friday, June 12, 2015 5:51 AM
To: Coltrain, Katrina; Werkema, Dale
Cc: Todd.Downham@deq.ok.gov; Prince, George; Powell, Greg
Subject: RE: Wilcox Call -- Purpose, DQOs, SOW, Schedule

Hi Dale – Keep in mind the geophysics techniques called out below were based on my “limited” geophysics knowledge. I hadn’t yet spoken with our geophysics experts when putting together the draft strategy. We’re having a meeting in Edison on Wednesday morning to discuss the actual details. It would be great to have you join in by phone if available. I can set up a conference call line. At this point, we want to get the best ideas from everyone to put forth the most effective approach. If we can get an idea where refinery wastes are located from the geophysics effort, that would be a big plus.

Tom

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From: Coltrain, Katrina
Sent: Friday, June 12, 2015 8:25 AM
To: Werkema, Dale
Cc: Kady, Thomas; Downham, Todd
Subject: FW: Wilcox Call -- Purpose, DQOs, SOW, Schedule

Dale, below are our objectives and our planned strategy for the site. I believe site information was sent previously, but if you have questions please let me know. Our primary thought was to delineate using direct sensing, but in your email you discuss the response of geophysical techniques to refinery waste. This is most interesting in that the use of geophysics may be able to help us focus our RI even tighter.

Please note that the ERT team will be finalizing all contracting documents within the next few weeks. We are interested in using these techniques to update and ‘verify’ our CSM such that we can perform a focused and streamlined RIFS. We are looking to develop an investigation work/sampling plan that will provide us with a good base for our CSM that we can build on with future sampling and remediation strategies. We have just completed residential sampling for organics, inorganics, pesticides and PCBs. The results should also assist us identifying our suites of concern.

Purpose:

- Build a CSM that will lead to more focused/tailored RI effort and better remedial decision
- Deploy rapid screening and direct sensing methodologies at the former Wilcox/Lorraine refinery operations facility and the former Wilcox tank farm area to gain an understanding of geology, hydrology, and nature and extent of contamination.
- This information will be used to develop a more comprehensive RI/FS, but one that is focused on determining appropriate remediation technologies and their cost/technical effectiveness.

Data Quality Objectives:

- What is the bedrock topography?
 - Are direct-push, direct-sensing technologies viable in this area?
 - Does the bedrock topography create preferential pathways?
- What subsurface structures and utilities exist?
 - Foundations?
 - Piping?
 - USTs?
 - Other?
- What array of COCs are likely at the refinery operations? In the northern tank farm area? In the eastern tank farm area?
- What rapid screening and direct sensing techniques are viable, given the answers to question above?

Scope of Work:

Geophysical survey – 2-3 week effort

- an essential first step to determine
- Preferential flow pathways
- Feasibility of direct sensing technologies
- Costs: ~125k (2 weeks), ~160k (3 weeks)

Direct sensing costs (general estimates – need geophysical work to determine specific scope):
Likely need 6 weeks for site this size

- Determine extent of refinery waste
- ~50k/week for LIF = (\$300k)
- Add'l costs for assays (pH, PAHs and TPH), well points/piezometers, soil cores, field testing
- ~50k (3 weeks @ 15k/week – GeoProbe with assay kits and field instruments.
Some lab work
- Data visualization ~50k

1. Refinery operations area

- Clear/grub major perimeter paths around the various operational units
- Perform subsurface utility markout of perimeters for suspected foundations, pipes, utilities, USTs, etc.
 - GPR
 - Magnetometry

- Determine depth of overburden (depth to bedrock surface)
- Screen soils for pH, metals, PAHs, TPH
- Determine and perform viable direct-sensing techniques
- Perform data visualization of subsurface geology and COC distribution

2. Tank farm areas

- Clear seismic/resistivity lines throughout tank farm areas
- Perform geophysical testing
 - GPR
 - Seismic
- Map bedrock topography
- Screen soils for pH, metals, PAHs, TPH
- Determine appropriate direct-sensing technologies, given the geology and preferential pathways
- Perform direct-sensing investigation
- Perform data visualization of subsurface geology and COC distribution

Tentative Schedule:

May/early June: PO to ERT from R6

June: Scoping/QAPP/Subcontractor bids (ERT/SERAS)

Late June / early July: Clearing (R6/ODEQ)

Geophysical survey/soil screening weeks of July 20 and July 27 (potential continuation in to week of Aug 3)

Data crunching/interpretation ~ 4wks; therefore, direct sensing work likely pushed to October

August/September: Bid/award direct sensing work

Direct sensing (Oct – mid Nov)

Data visualization – one day lag during field work; 3-4 weeks of refining after demobilization

December: Refine data visualization and preliminary conceptual site model (CSM)